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THE EFFECTIVENESS OF FISCAL AND MONETARY POLICY: CASE OF UZBEKISTAN

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ЭФФЕКТИВНОСТЬ ФИСКАЛЬНОЙ И ДЕНЕЖНОЙ ПОЛИТИКИ
(на примере Узбекистана)

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Abstract. The article examines an effectiveness of government monetary and fiscal policy for Uzbekistan by constricting IS-curve for goods market and LM-curve for money market, simultaneously. For the both markets equilibrium interest rate is also determined. The results show that the variables are co integrated, that the variables have long-run or short-run equilibrium relationship between them. According to the empirical results, the long-run equilibrium interest rate for covered period was 22.0% for Uzbekistan, for the current period we recommend the equilibrium interest rate around 15%.

Аннотация. В статье анализируется эффективность государственной фискальной и монетарной политики Узбекистана путем разработки IS-кривой для рынка товаров и услуг и LM-кривой для монетарной политики одновременно. Предложена равновесная процентная ставка. Результаты исследования показали существование краткосрочной и долгосрочной ковариации между переменными. Для Узбекистана долгосрочная процентная ставка за исследуемый период 2000–2018 гг. в среднем составила 22,0%, а для кратковременного периода мы рекомендуем около 15%.

Keywords: Uzbekistan, IS-LM model, fiscal and monetary policy, IS-curve, goods market, LM-curve, money market, unit root, cointegration.

Ключевые слова: Узбекистан, IS-LM модель, фискальная и монетарная политика, IS-кривая, рынок товаров, LM-кривая, денежный рынок, единичный корень, коинтеграция.

Introduction

The effectiveness of Government regulation of the economy by providing fiscal and monetary policies, especially in developing countries, like Uzbekistan, is on the focus of many researchers. The IS-LM model is still considered an essential tool in macroeconomics [1, p.199]. This model can play an essential role in the sustainable growth of a country since it represents the simultaneous equilibrium of both goods and money markets. This model helps policy makers to determine and interpret the right macroeconomic policy implementing to the economy of a country. This sphere for Uzbekistan has not been researched yet. Therefore, the main aim of this paper is to construct the IS-LM model for the economy of Uzbekistan and to find equilibrium development of both goods and money market. At the same time, this paper learns the macroeconomic policy effects on the domestic economy in the short and long term. This study analyses the period of 2000-2017. In research pooled ordinary least squares (OLS) method is used to obtain and examine results.

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According to the 2019 statistics Uzbekistan has moved from 87th place in 2015 to 69th place in the “Doing Business” ranking of the World Bank by taking steps to impact on the welfare of ordinary citizens and creating opportunities for businesses to operate.

Literature review

The efficiency of Government regulation of the economy is debated by many researchers. Ahmed D. [2] considers the IS-LM model could be a substantial tool for policymaker and academicians to analyse policy. Mankiw [3] stated the IS-LM model as the best way to interpret macroeconomic policy. Blanchard [4] also, supportively to Mankiw (1990), describes the ISLM model as the core of macroeconomics. From the results of the IS-LM model for Zimbabwe, Lyman Mlambo concluded that fiscal-policy would cause growth in Zimbabwe economy and the monetary policy could be supportive [5, p. 340]. The cause was that the IS curve demonstrated vertical shape while LM was almost horizontal based on the IS-LM model for Zimbabwe (Mlambo, 2013, p.339). The problem in implementing monetary policy, Mlambo (2013) faced, was that the interest rate changes do not have a significant effect on Investment while the interest rate is the route of monetary policy. By contemplating these statements of academicians, I support all their definitions about the IS-LM model. Simultaneously, I am expecting that our IS-LM model for Uzbekistan would demonstrate opposite results compared to Zimbabwe. That is our LM curve would be steeper than the IS curve that makes us realize monetary policy as an effective policy than fiscal policy.

Monetary policy is considered as the main instrument in macroeconomics to maintain the stability of the economy. However, some countries might be a negative relationship between money supply and economic development in the long run. That is, a change in the money supply would impact negatively on economic growth in the long run.

Moreover, according to Duskobulov U. [6], the money supply has a long-term unidirectional causal effect on the sustainable growth of Uzbekistan. Their results showed that money policy (money supply) has a negative impact on real GDP in the short run; however, as the lags increase the effect becomes insignificant. Overall, we can conclude that the proper use of monetary policy can contribute to maintaining sustainable growth of the Uzbek economy.

The IS curve illustrates the equilibrium of the goods market, the inverse relationship between the interest rate and real GDP. As the interest rate increases the investment in the country decrease which leads to a decrease in the real GDP. The equation of the IS curve is derived from the aggregate demand equation. That is:

Aggregate Demand = C +I +G (for closed economy)

Equilibrium on the goods market: Y (income) = Aggregate Demand

And the IS equation: Y= C (T, Y) + I (r) + G

Where:

Y — income (GDP identity)

C — Total consumption and is a function of T (tax revenues) and Y (output)

I — investment is a function of r (interest rate) and G — government expenditure.

The tool of the IS curve is fiscal policy, which can be used to change the equilibrium of output (real GDP) and interest rate by the means of changes in taxes and government expenditures [7]. That is, any shift in the IS curve happens due to the changes in taxes and government expenditure. According to the IS-LM model, an increase in government expenditure and/or decrease in taxes shifts the IS curve to the right, which leads to interest rate and income increasing.

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Research Methodology

This research used a wide range of secondary data of Uzbekistan for the period 2000-2017. The indicators all are in million USD. The main portion of the data was obtained from the Asian Development Bank Database [8] and Statistic Committee of Uzbekistan. Additionally, the length of the period is prescribed by the data availability of the variables in this model. This research considers gross capital formation as a proxy of investment.

Table 1

VARIABLE DESCRIPTION

Variable	*Symbol*	*Description*	*Source*
National Income	Y	Real GDP calculated by considering	Asian Development Bank Estimates
Investment	I	Gross capital formation (in USD)	Asian Development Bank Estimates
Consumption	C	Household final consumption (in USD)	Asian Development Bank Estimates
Government Expenditure	G	Government purchases	World Bank Estimates
Tax Revenue	T	Tax revenues ()	Asian Development Bank Estimates
Money Supply	M2	Money supply	Asian Development Bank Estimates
Interest Rate	r	Interest rate (in %)	Asian Development Bank Estimates from 2013 to 2017
Disposable Income	Yd		Derived

Pre-estimation analyses

In this subsection, two main pre-estimation tests are employed; these are unit root and cointegration tests. First, the Augmented Dickey-Fuller (ADF) test is applied to check the stationary of the variables. In these test, significant p-values prove the stationarity of the variables, as the null hypothesis (Ho) states that the testing variable contains a unit root. Knowing that the all variables are non-stationary at level, second, Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test and Cointegrating Regression Durbin-Watson (CRDW) Tests are employed to check the cointegration between the variables under study. Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test shows whether the variables are cointegrated or not. This test uses a residual term to determine the relationship. Cointegrating Regression Durbin-Watson (CRDW) Test is an easier and quicker method to check the cointegration between variables.

Research Results

The ADF test is used to check the stationarity of the variables. This test contains the difference of the testing variable as a dependent variable and trend, lag of the variable and the lag difference of the variable as independent variables. Symbolically:

$$\Delta Yt=\beta 0 + \beta 1\ t + \delta Yt\text{-}1 + \sum_{i=1}^{m} \alpha i\ \Delta Yt\text{-}1 + \varepsilon t \quad (1)$$

Where ΔYt is the difference of a time series variable under study, t is a trend, Yt-1 is lagged values of the dependent variable and εt is random error term [9, p. 836].

This paper runs the regression model above for each variable of the IS-LM model in order to check whether they are stationary or nonstationary. The results showed that all variables are no

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stationary, that they contain a unit root. t values of all variables are insignificant even at the 10% level.

Table 2.

ADF TEST RESULTS

Variable	*ADF test statistic*			*Order of*
Level	1st difference	2nd difference	integration	
Y	-0.919	-1.496	-1.341	
C	-0.786	-1.762	-1.432	
T	-1.051	-1.999	-2.728*	I (2)
G	-1.079	-2.028	-2.223	
I	-1.229	-1.439	-2.076	
r	-0.513	0.133	2.100	
M2	4.672	2.297	1.669	
Yd	-0.706	0.669	1.950	

Table (2) also shows the ADF test results obtained in an alternative way. According to these results, only one variable of Tax revenues in the model is stationary at 2nd difference at 10% significance, while-3.750, -3.000 and -2.630 are the critical values at 1%, 5% and 10% significant levels, respectively. All other variables contain a unit root, that they are nonstationary at level, 1st and 2nddifference.

Now it is obvious that all variables have the problems associated with nonstationary time series. Running a regression with nonstationary variables may cause the spurious regression issue. To avoid this problem, the nonstationary time series have to be transformed to make them stationary. In order to transfer, first, we should identify whether the variables are difference stationary (DSP) or trend stationery (TSP). We check the time series with each of these methods in turn.

The difference — Stationary Processes (DSP). In this method, we just run the first difference of a time series variable under study with its lagged value. Symbolically:

$$\Delta Yt = \beta 0 + \beta 1 \Delta Yt\text{-}1 \quad (2)$$

Where ΔYt is the first difference of a time series and ΔYt-1=(Yt-Yt-1) [9, p. 839]. Then we check the t value of the lagged value of the time series after running the regression with -3.5064, -2.8947 and -2.5842 critical values for this model at 1, 5 and 10 percent, respectively.

The results showed that all of the time series are not difference stationary, except money supply (M2), that the t value are not significant at these critical values.

Trend-Stationary Process (TSP). This method shows whether the unit root time series is trend stationary or not. For this method the following regression should be run:

$$Yt = \beta 0 + \beta 1 t + ut \quad (3)$$

Running a regression of a time series with time makes the residual stationery [9, p.840]. From the results, it is clear that all of the time series is trend stationery, as the p-values are significant at 1% significance level. Now it is obvious that all of the time series is trend stationary. That means taking the difference of variables to avoid the unit root problem is useless. The question is what to do in order to avoid spurious regression due to unit root? As the IS-LM model contains several simultaneous-equation models, cointegration test can be applied. Cointegration test, in other words, regression of a unit root time series on another unit root time series, shows the long-run or

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equilibrium relation between time series variables. This paper applies two testing methods for cointegration between variables: Engle-Granger (EG) or Augmented Engle-Granger (AEG) Test and Cointegrating Regression Durbin-Watson (CRDW) test.

Augmented Engle-Granger (AEG) test. It is obvious that our time series are not stationary at a level that they contain a unit root. Therefore, regressions on equations (4), (5), (6) and (7), that is cointegrating regressions, may be spurious. AEG test is one method to define whether these regressions are spurious in the long run or not.

To apply this test, first, we run regressions on the equations:

$$Ct = c0+c1 \cdot Ydt \quad (4)$$

$$Tt= \alpha0+ \alpha1 \cdot Yt \quad (5)$$

$$It = \gamma0 + \gamma1 \cdot r \quad (6)$$

$$Ms0= \varphi0+\varphi1 \cdot Yt- \varphi2 \cdot r \quad (7)$$

In this case the regressions (4), (5), (6) and (7) are known as co integrating regressions and the coefficients c1, α1, γ1, φ1and φ2are co integrating parameters. Second, we obtain residuals from each of these co integrating regressions and we run regression with the residual's lagged value for each. Symbolically:

$$\Delta\hat{u}t = \beta1 \cdot \hat{u}t-1 \quad (8)$$

This paper runs this for each cointegrating regressions and compares t values obtained from regression (8) with τ (tau) critical values of -2.5897, -1.9439 and -1.6177 at 1, 5 and 10% significance level, respectively. That is, the study checks for cointegration between first Consumption (Ct) and Disposable income (Yet), Tax revenues (T) and National income (Y), Investment (It) and Interest rate (r), and finally Money supply (Mst), National income (Y) and Interest rate (r). The results obtained from our case shows that the indicators in the equation models (4) and (7) are co integrated as the values are significant at 5% critical value. The variables in other models (5) and (6) are not co integrated.

Co integrating Regression Durbin-Watson (CRDW) test. This test is considered as an alternative and quicker method to find whether the variables are co integrated or not. According to this test, the null hypothesis is that the Durbin-Watson statistics is equal to zero (d=0) while the standard d=2 [9, p.843]. This method compares the Durban-Watson statistics (d) obtained from the regressions (4), (5), (6) and (7) with the critical values of 0.511, 0.386 and 0.322at 1, 5 and 10% significance level, respectively. The results show that all Durban-Watson statistics d obtained from the regressions (4), (5), (6) and (7) are 0.623, 0.572, 0.765 and 1.349 (Table 3).

All values are significant at 1% significance level, suggesting that the variables in the regressions above are co integrated. This is, the variables have a stable long-run or equilibrium relationship between them, although they individually contain a unit root.

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Table 3.

REGRESSION RESULTS INCLUDING DURBIN WATSON STATISTICS

	(1)	*(2)*	*(3)*	*(4)*
VARIABLES	C	T	I	M2
Yd	0.685***			
	(0.036)			
Y		0.247***		0.233***
		(0.025)		(0.059)
R			-169,458.665***	-81,426.777**
			(40,450.704)	(31,659.474)
Constant	-1,784.994	-2,791.958**	47,274.560***	17,640.775*
	(1,173.239)	(968.418)	(9,197.144)	(9,122.993)
Durbin Watson	0.6226111	0.5719152	0.7649284	1.349376
Observations	18	18	18	18
R-squared	0.957	0.863	0.523	0.921
Standard errors in parentheses				

*** p<0.01, ** p<0.05, * p<0.1

Long-run results

According to the co integration test results, variables in all four regression models (equations) of the IS-LM model under study are co integrated to each other, that there is long-run or equilibrium relationship between these variables [9, p. 825]. Thus, the results obtained from regression models (4), (5), (6) and (7) are considered long-run results of the IS and LM curves (Table 3).

The long-run IS curve:

The parameter to draw IS curve can be derived from the results.

c0= - 1785, c1=0.685, α0= - 2792, α1=0.247, γ0= 47274.6, γ1= - 169458.7

Now the parameters are put into equation (9) (Yt= π0 + π1r). Here is the numeric version of IS equation.

$$Yt= 112067.2 – 349975.2\ r \quad (9)$$

Then this paper gives percentage values to interest rate (r) and draws IS curve:

The long-run IS curve of Uzbekistan is downward-sloping, as the theory states. Now this paper determines the fiscal policy effects on real GDP:

The government expenditure multiplier is equal to: $\frac{1}{(1-c1(1-\alpha1))} = \frac{1}{(1-0.685(1-0.247))} = \frac{1}{0.4842} = 2.07$

That is, one dollar US increase/decrease in government expenditure causes 2.07 USD increase / decrease in real GDP of the country.

The tax multiplier is: $-\frac{c1}{(1-c1(1-\alpha1))} = -\frac{0.685}{0.4842} = -1.41$

This negative number means that one USD increase/ decrease in tax revenues causes 1.41 USD decrease/increase in the real GDP.

The long-run LM curve

Then this paper derives the parameters to draw LM curve from the results of the equation (7), which is (Table3).

φ0= 17,640.775 φ1= 0.233 φ2=-81,426.777

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After putting these parameters into equation (13), that is Yt= β0 + β1 Ms0 + β2 r

Where $\beta 0 = -\frac{\varphi 0}{\varphi 1}$

$\beta 1 = \frac{1}{\varphi 1}$ (the money supply multiplier)

$\beta 2 = \frac{\varphi 2}{\varphi 1}$

The LM equation numerically forms as follows:

$$Yt= - 75711.5 +4.292 Ms0 + 349\ 471.1\ r \quad (10)$$

The coefficient of money supply shows the multiplier of this indicator, that the multiplier shows the money supply effect on real GDP. Obviously, one USD increase/decrease in money supply will affect 4.292 USD increase/ decrease in the real GDP of Uzbekistan.

Then Ms0 is considered the mean values of annual money supply (Mst) in the economy for the analyzing period. The mean of annual money supply in the economy from 2000 to 2017 is equal to 7858.8 million USD. Now this paper rewrites the numeric LM equation (10) and draws the long-run LM curve for Uzbekistan:

$$= - 41\ 981.5–349\ 471.1\ r$$

Simultaneously, this paper derives long-run equilibrium interest rate for Uzbekistan. The equilibrium interest rate is found by equalizing the IS and LM equations, which both are defining National income (Yt). According to the calculations, the long-run equilibrium interest rate for Uzbekistan is 22.0%.

Error Correction Mechanism (ECM), in other words, short-run results.

The test results show that the variables are co integrated. We can conclude that, that there is long-term or equilibrium relationship between them. Now, this method ties short term behavior of the dependent variables of the regressions to their long term value with the help of error term. According to the Granger representation theorem, which's popularized this mechanism, the relationship between two variables is able to be explained as ECM when the variables are co integrated. In this method, a regression is run, which contains difference value of dependent variable in the left side and difference values of independent variables including lagged value of residual in the right side of the model. Symbolically:

$$\Delta Yt= \beta 0 + \beta 1 \Delta Xt + \delta 2\ ut\text{-}1 + \varepsilon t \quad (11)$$

Where ΔYt= Yt – Yt-1 and ut-1 is lagged value of error term (ut-1=ΔYt-1- β0 - β1ΔXt-1) and εt random residual [9, p. 867].

The regressions are run on each of the equation models (4), (5), (6) and (7) based on this mechanism.

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Table 4.

ECM (Short-run) results

	(1)	(3)	(4)	(12)
VARIABLES	D.C	D.T	D.I	D.M2
D.Yd	0.998***			
	(0.062)			
L.resid2	-0.377***			
	(0.115)			
D.Y		0.447***		-0.069
		(0.055)		(0.041)
L.resid3		-0.542**		
		(0.230)		
D.r			11,035.344	-28,434.835**
			(64,294.229)	(12,950.160)
L.resid4			-0.003	
			(0.236)	
L.resid5				-0.406**
				(0.183)
Constant	-775.308***	-545.299**	397.003	867.495***
	(189.218)	(200.188)	(751.380)	(194.669)
Observations	17	17	17	17
R-squared	0.952	0.838	0.003	0.457
Standard errors in parentheses				

*** p<0.01, ** p<0.05, * p<0.1

Conclusion

The results show that the interest rate does not affect investment in the short term, as the coefficient of the rate of interest is insignificant. That is, the short-run IS curve represents a vertical relationship between the rate of interest and output.

There is a similar problem in money market also. The output has little to do with money supply in the short term, that this does not allow us to derive LM equation and draw the LM curve for the economy.

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